ACTIVITY PATTERNS OF CANADA GEESE DURING WINTER

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It is common knowledge that activity patterns of wild geese are correlated with weather conditions. Geese usually fly to feeding areas in the early morning and late afternoons but undertake increased flight activity throughout the day when it is stormy. In conjunction with a study of social behavior and local movements of Canada Geese (*Branta canadensis*) during winter (Raveling, 1969*a–c*; 1970) exact times of flight activities of a large wintering flock were recorded almost daily for two seasons. Specific records of times of flights were also available from radio-marked geese of known age, sex, and social class (i.e., family, pair, single). This paper documents the activity rhythms of a large winter flock of Canada Geese and of some specific individuals within that flock, and the environmental features associated with goose activity. Such knowledge is necessary for understanding the ecological relationships associated with an animal's activity and can usually be utilized in management of exploited species.

METHODS

Observation of the times of flight and activities of the flock were made almost daily from late September to mid-March in 1963–64 and 1964-65 at Crab Orchard National Wildlife Refuge, Williamson County, Illinois. Approximately 40,000 Canada Geese (*B. c. interior*; see Hanson and Smith, 1950:77) spent the major portion of the winter period on and near this refuge. The inviolate portion of the refuge used by the geese included 2,600 acres of Crab Orchard Lake where the birds roosted, and 5,000 acres of cropland (corn and soybeans) and 2,800 acres of pasture where the geese fed.

The geese roosted mainly at the lake (Raveling, 1969*b*). Observers were usually in the same locations each day and in position to note accurately the time at which the first geese flew (either out from or back to the lake) and when flights were "heavy." The notation of heavy flight was relative to total numbers of geese in the area. This could be as few as 10,000 in October or March and as many as 60,000 in January. The start and ending of a period of heavy flight represented judgments of the time periods in which many flocks were leaving or arriving from different areas at the same time. In general, the period of heavy flight included movement of an estimated 75+ per cent of the geese present.

During the two winters, 77 Canada Geese were color-marked and outfitted with miniature radio transmitters. These included parts or all members of 10 families, 2 pairs, and 35 yearlings. Data recorded regularly from transmitter-marked geese included: lake locations before flight in the morning and afternoons, times of flight out from and back to the lake and changes in feeding areas, and locations in fields. Flight times of radio-marked geese were easily determined by continuous scanning of the frequency range receiving their signals. The instant these birds flew, large increases in auditory signal

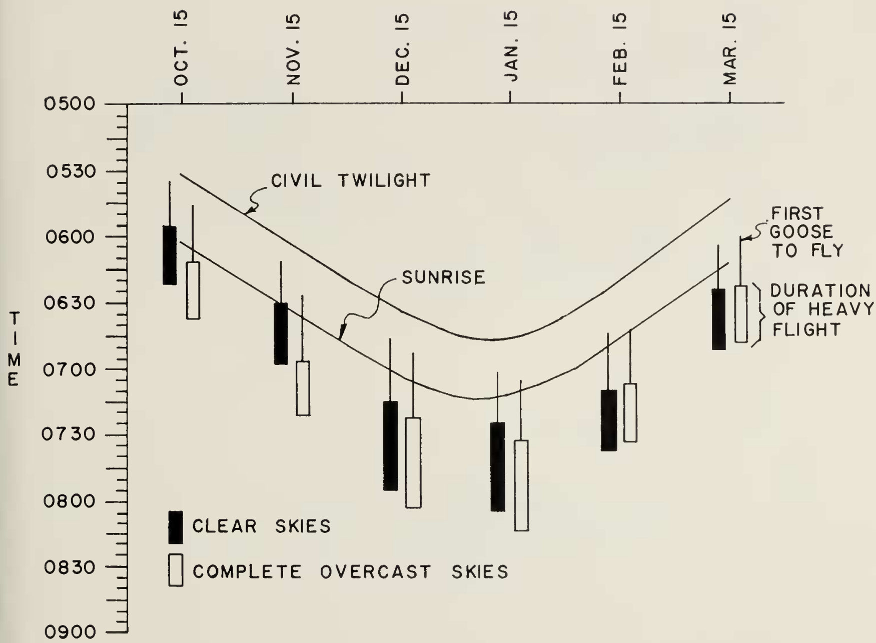

FIG. 1. Generalized average morning flight pattern of Canada Geese from the roost lake under clear and complete overcast skies (civil twilight and sunrise from U. S. Naval Observatory, 1961, 1962, 1963).

strength occurred which then faded suddenly or disappeared at the termination of a flight. Details on the techniques of radio-tracking and color-marking, and recognition and permanency of families of geese and other social classes are provided in Raveling (1969*a*).

Temperature and humidity were recorded on a hygrothermograph at the refuge. Notes were kept on cloud cover, wind direction, precipitation, and disturbances affecting the movements and locations of geese. Cloud cover was recorded as none, partly (< 50 per cent), mostly (> 50 per cent), or complete.

MORNING FLIGHTS FROM THE LAKE

Initiation.—At the latitude of Crab Orchard, civil twilight occurs within 26 to 29 minutes before sunrise and after sunset and the increase and decrease of light intensity during these minutes is approximately eighty-fold (Kimball. 1916). With the exception of the coldest days in winter, morning goose activity began within this period of rapidly increasing light (Fig. 1).

In October and November under clear or partly cloudy skies, the first geese to fly did so within 10 minutes after dawn civil twilight; from December into March, when temperatures were above 20° F, the first flying geese were re-

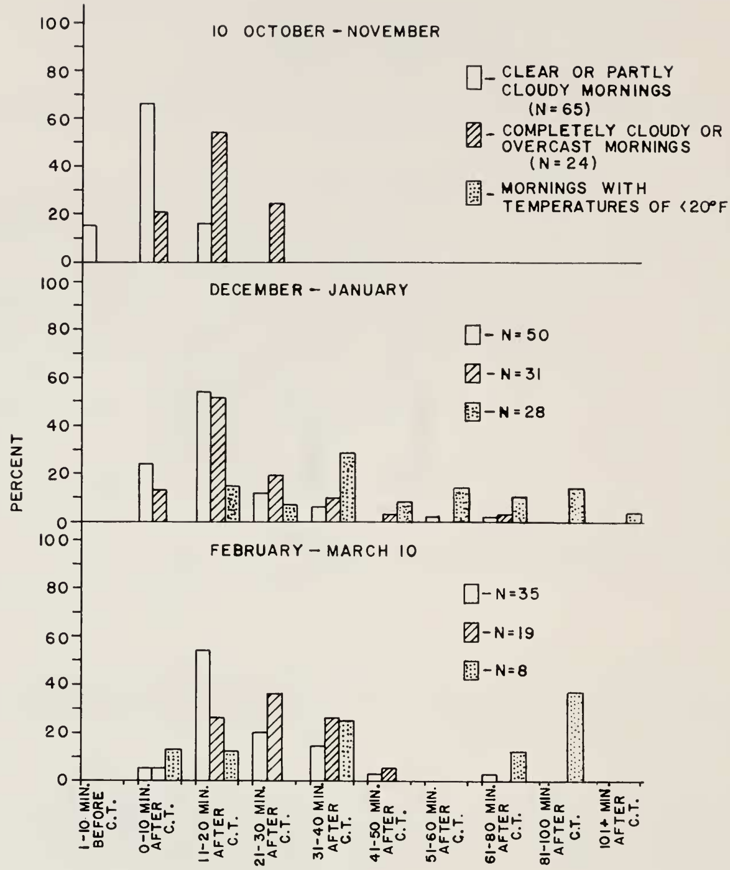

FIG. 2. Time period in which the first geese flew in relation to dawn civil twilight (C.T.).

corded somewhat later, usually within 20 minutes after civil twilight (Fig. 2). Completely cloudy conditions usually delayed the time of first flight by approximately 10–15 minutes. Flight times were less predictable under cloudy conditions. The delay of the first geese to fly during the darker, cloudy mornings was more pronounced during periods when the first geese had been leaving near the time of civil twilight rather than a few minutes later.

The time lag between the first geese to fly and the start of the heavy flight was relatively constant regardless of variations in time of first flight and the cloud cover (Fig. 3). Concentrated flights usually began between 10–30 minutes after the geese flew. When a dense fog occurred the heavy flight was delayed up to 1.5 hours after the time the first geese flew. In general, the

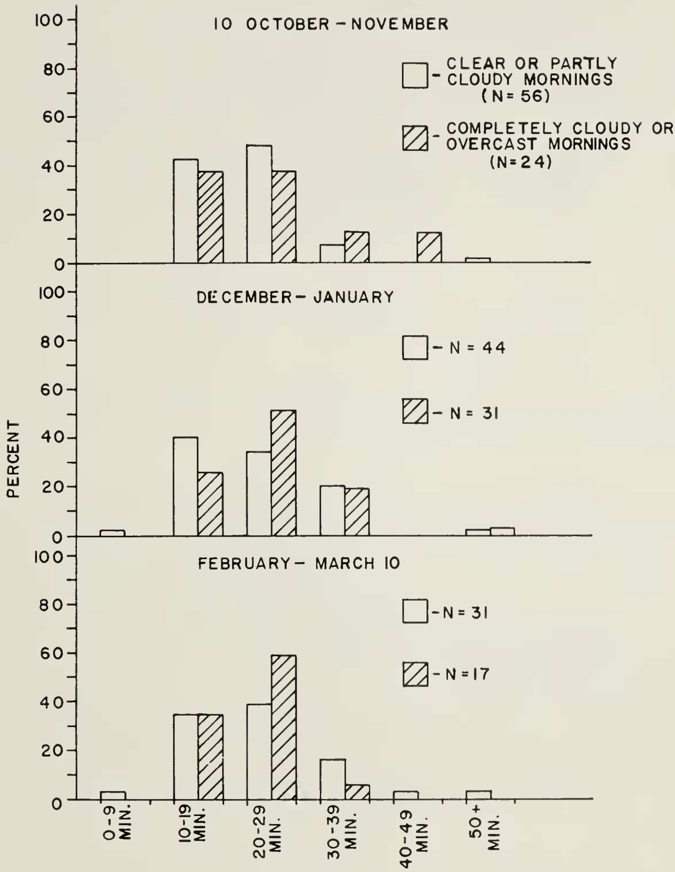

FIG. 3. Time lag between first geese to fly and the start of the heavy flight in the mornings.

factors causing later initial flight also caused a corresponding time lag in the flock as a whole. This suggests that the activities of the birds themselves were also of importance in synchronization of flight times of the majority of the flock.

Temperature.—The most striking factor influencing both the time and the magnitude of morning flights was temperature (Table 1). When temperatures were below 15° F at sunrise there usually was no heavy flight. On the coldest days only a few or often no geese would fly out to feed. When temperatures were between 16° and 20° F there occasionally was no heavy flight, but more often a partial flight or a normal flight occurred. Above 20° F there almost always was a heavy flight of geese in the morning.

TABLE 1

EFFECTS OF TEMPERATURE ON THE MAGNITUDE OF THE MORNING FLIGHT OF CANADA GEESE IN SOUTHERN ILLINOIS IN THE WINTERS OF 1963–64 AND 1964–65.

Sunrise temperature (° F)	Number of days within each temperature range	Number of days in which no heavy morning flight occurred	Number of days in which morning flight was intermediate*	Number of days in which morning flight was normal**
–5 to 5	12	12 (100%)	0	0
6 to 10	10	9 (90%)	1 (10%)	0
11 to 15	13	11 (85%)	1 (7.7%)	1 (7.7%)
16 to 20	23	5 (22%)	8 (35%)	10 (43%)
21 to 25	33	0	1 (3%)	32 (97%)
26 to 30	34	1 (3%)	1 (3%)	32 (94%)

* Many geese flew but many did not (40–60% flew or remained).
** Great majority of geese flew (>90%).

Temperatures between 16° and 20° F represent a relatively narrow threshold at which these Canada geese did or did not fly in large numbers. Below 15° F the geese spent a great amount of time apparently sleeping with the bill placed under the scapular feathers and the feet and tarsi drawn into the flank feathers. Activity was minimal and the tendency to flee from predators or other disturbances was markedly reduced.

This notable response to environmental temperatures was rather precise but is variable within the species as correlated with body size (Table 2).

TABLE 2

RELATIONSHIP BETWEEN ENVIRONMENTAL TEMPERATURES AT WHICH THREE SUBSPECIES OF CANADA GEESE BECOME INACTIVE AND THE PREDICTED LOWEST LONG-TERM TEMPERATURE AT WHICH THE IMMATURE FEMALE OF EACH RACE COULD SURVIVE FOR EXTENDED PERIODS.

Subspecies	Temperature at which inactivity begins (° F)	Source	Predicted lowest long-term existence temperature (° F)	Source
maxima	0° to –5°	Personal observations	+5°	Birkebak et al. (1966*a*)
interior	15°	This paper	14°	This paper (following methodology of Birkebak, et al., 1966*b*)
parvipes	ca. 30°	L. A. Mehrhoff, Jr. (personal communication)	32°	Birkebak et al. (1966*a*)

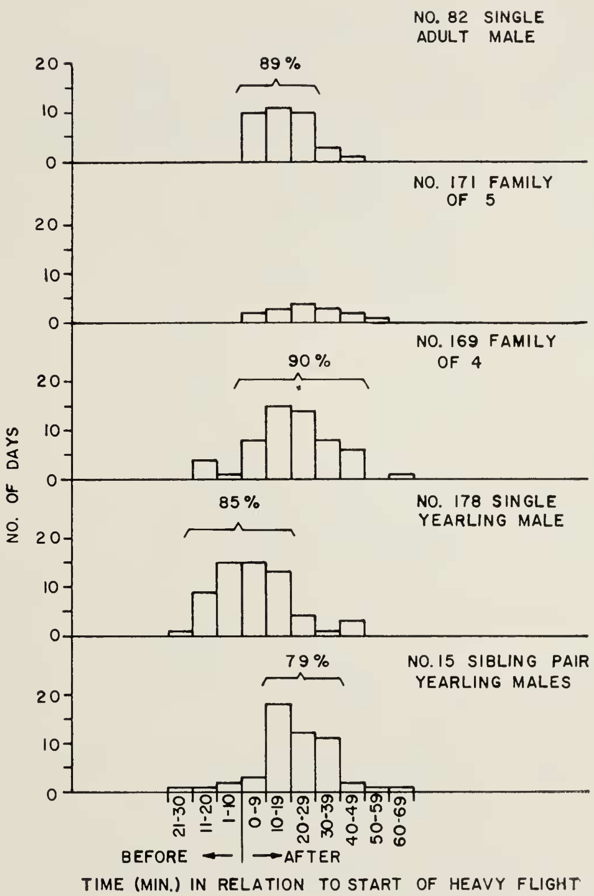

FIG. 4. Times of morning flights away from the roost lake of radio-marked Canada Geese in relation to times of initiation of heavy flight of the entire flock.

Maxima is the largest race of Canada goose (Hanson, 1965:13–41) while *parvipes* (*hutchinsii-parvipes* complex of MacInnes, 1966) is one of the smallest and *interior* is intermediate between the two (Hanson, 1951).

Flight Pattern of Radio-marked Geese.—The fact that the flock as a whole exhibited marked regularity in relation to civil twilight and sunrise in the times of first flights and initiation of heavy flights suggested that individual birds and families might initiate flight in a pattern of constancy with respect to light and the flight pattern of the entire flock. Comparison of flight times of transmitter-geese with the patterns for the entire flock revealed that for certain periods (up to six consecutive days) some marked geese were pre-

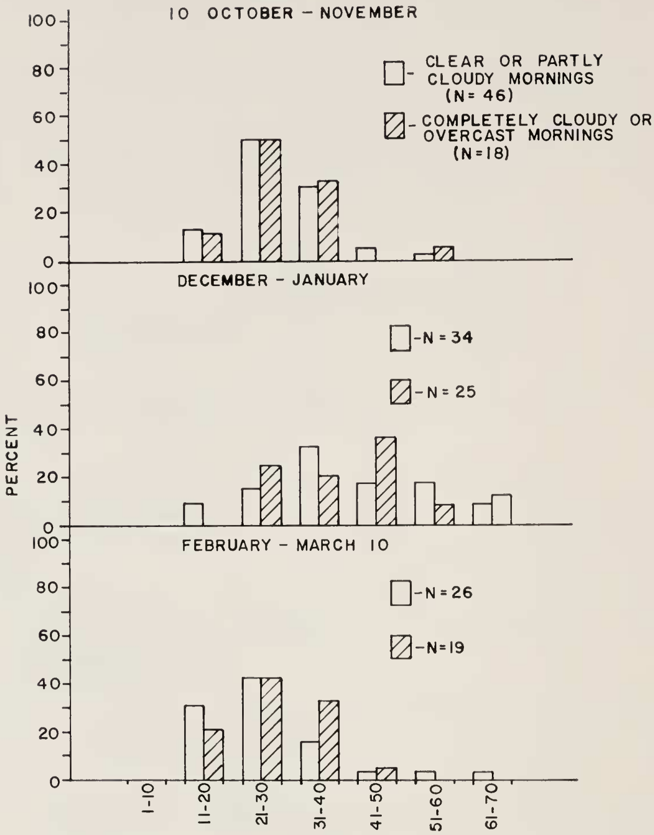

FIG. 5. Duration (minutes) of the heavy morning flight.

dictable within 5 minutes as to when they would fly in relation to the initiation of heavy flight. At other times the same birds were unpredictable and variable in the times at which they flew. When radio-tracked over a period of weeks, it was demonstrated that any individual or family might fly at almost any time within the period of heavy flight of the flock as a whole (Fig. 4).

Duration.—During October and November the heavy flight usually lasted from 20–40 minutes (Fig. 5). The duration of heavy morning flight in December and January was longer and more variable than at other times. This may be a reflection of greater numbers of geese at the refuge and also colder average temperatures which may delay or prolong activity. Heavy flights in February and March usually lasted from 15–40 minutes. Cloud cover had little, if any, effect in prolonging the morning flight once it was started even though it may have initially delayed it. The last geese to depart from the lake

Table 3

Length of Time (minutes) that Radio- and color-marked Canada Geese Remained in Feeding Fields in the Mornings under Different Cloud Conditions and at Different Periods of the Winter (1963–64 and 1964–65).

Time of year	Sky Conditions		
	Clear or partly cloudy	Mostly cloudy	Complete overcast
15–31 October	134 ± 8* (N = 20)	154 ± 11 (N = 14)	192** (N = 4)
1–15 November	147 ± 6 (N = 32)	152 ± 10 (N = 9)	231 ± 14 (N = 15)
16–30 November	138 ± 17 (N = 14)	164 ± 12 (N = 14)	203 ± 7 (N = 18)
1–31 December	165** (N = 5)	142 ± 7 (N = 10)	210 ± 20 (N = 10)
1–30 January	121 ± 11 (N = 16)	169 ± 17 (N = 17)	254 ± 16 (N = 33)

* Mean ± standard error.
** Variation about mean not calculated because of insufficient sample size.

in the morning usually did so from 10 to 30 minutes after the heavy flight had ended.

MORNING FEEDING PERIOD AND MIDDAY ACTIVITY

When clear weather prevailed during October and November and almost all the geese were feeding on the refuge near the lake, the flight pattern back to the lake after feeding was almost as regular as the early morning departure. The sight and sound of flying geese appeared to stimulate nearby geese on the ground to fly also and this resulted in regular mass return flights to the roost lake. The geese spent an average of just over 2 hours in the fields (Table 3). On completely cloudy days geese remained in fields over twice as long as on clear days after their initial flight from the roost lake and then scattered segments of the flock moved back and forth from the lake all day.

As the season progressed and available food at Crab Orchard Refuge was exhausted (i.e., late December), the geese flew out farther (up to 10 miles and occasionally more) and split into more widely separated subflocks (see Raveling, 1969*b*). These subflocks usually returned to Crab Orchard at different times, especially if they were separated in their feed-field locations far enough apart not to hear or see other subflocks returning to the lake. When this pattern prevailed, it was impossible to record beginnings and endings of a heavy flight that represented meaningful averages for the entire flock.

TABLE 4

LENGTH OF TIME (MINUTES) THAT RADIO- AND COLOR-MARKED CANADA GEESE REMAINED IN FEEDING FIELDS IN THE AFTERNOON UNDER DIFFERENT CLOUD CONDITIONS AND AT DIFFERENT PERIODS OF THE WINTER (1963–64 AND 1964–65).

	Sky Conditions		
Time of Year	Clear or partly cloudy	Mostly cloudy	Complete overcast
15–31 October	55 ± 5* (N = 19)	71** (N = 4)	80** (N = 3)
1–15 November	77 ± 5 (N = 32)	65 ± 6 (N = 11)	—
16–30 November	74 ± 12 (N = 15)	—	—
1–31 December	64** (N = 6)	102** (N = 3)	92** (N = 3)
1–15 January	70 ± 5 (N = 30)	—	111** (N = 8)
16–30 January	65 ± 7 (N = 20)	81** (N = 7)	63** (N = 4)

* Mean ± standard error.
** Variation about mean not calculated because of insufficient sample size.

Data on the length of morning feeding periods of the radio-marked individuals demonstrate that, under equal cloud conditions, geese did not remain out for a longer time during the colder mid-winter or when they had to fly farther to feed (Table 3).

AFTERNOON FLIGHTS AND FEEDING PERIODS

Afternoon flight times of the geese from the roost lake to feeding areas were more variable than in the morning, especially on cloudy days. Even on clear days, small groups of geese left the lake from 1 to 3 hours before the time when the heavy flight occurred as the light level was fading. The correlation of goose activity to light intensity was less prominent in the afternoon than in the morning and this seems to be true for many birds (Armstrong, 1954); but, there remained a predictable flight time for the majority of geese during clear weather. As in the morning, the amount of time spent in feeding areas in the afternoon under clear skies was relatively constant throughout the winter and averaged about 1 hour (Table 4).

The evening flight from feeding areas to the roost lake varied widely (Fig. 6). This variation was due largely to completely cloudy conditions. Data on the start of the heavy flight on cloudy afternoons were often missing

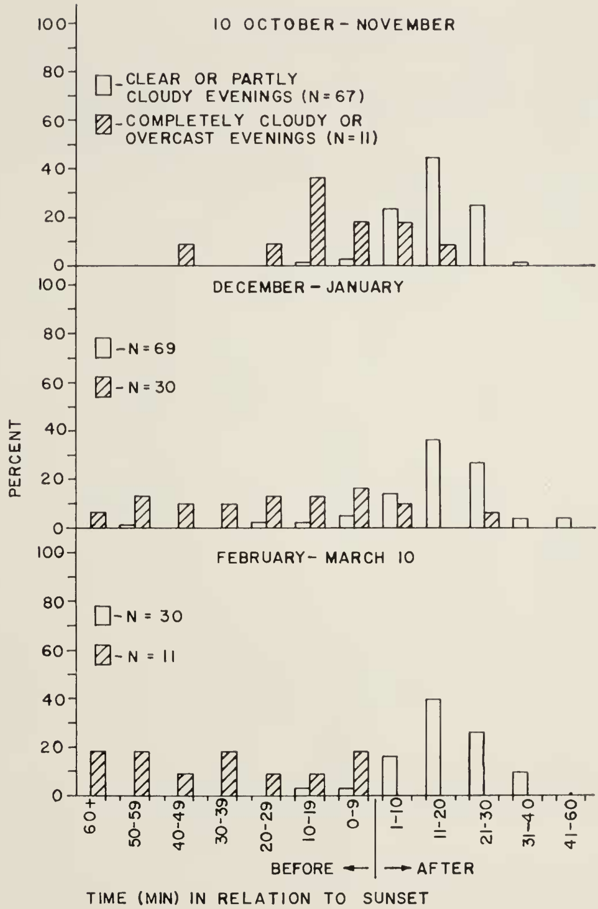

FIG. 6. Time period in which the heavy flight to the roost lake started in the afternoons in relation to sunset.

because the geese arrived over a longer time and often no definite peak flight was observed. During clear weather the heavy flight usually began between sunset and civil twilight; times later than this usually represented evenings when a full or nearly full moon was visible at sunset. When cloudy, the evening flight to the lake almost always occurred before sunset.

Once flight back to the lake was initiated, it quickly became heavy and lasted for 15 to 40 minutes when skies were clear (Fig. 7). As with the morning flight out (Fig. 5), duration of the evening flight back was 5 to 10 minutes longer in December—January than earlier or later in the winter. This probably represents the effects of greater numbers of geese.

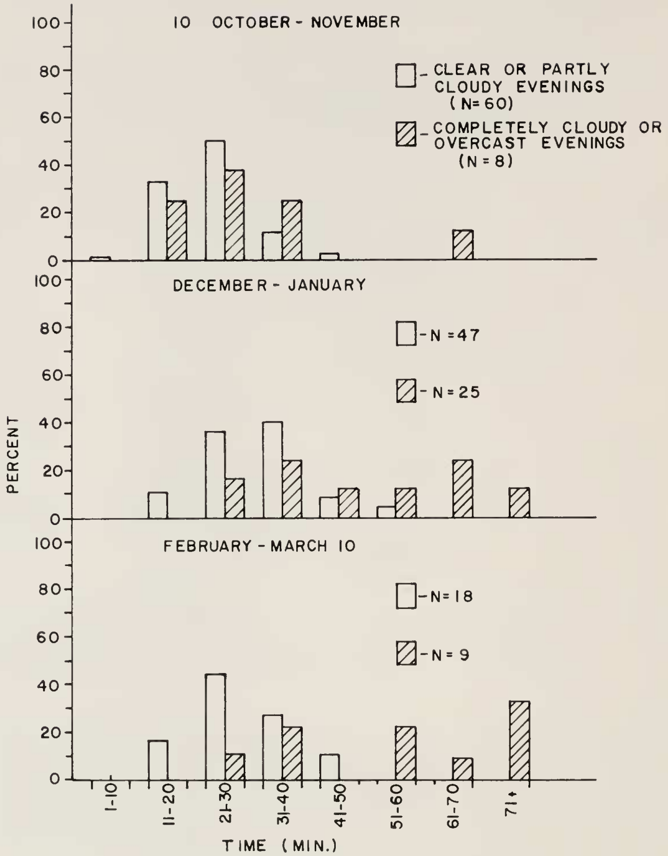

Fig. 7. Duration of the heavy evening flight.

The last geese to return to the lake usually did so within 5 to 20 minutes after the heavy flight ceased. The last returning geese were often from 10 to 30 minutes or occasionally more after civil twilight. Evening feeding periods were shorter and goose activity was more intense than during morning feeding periods. The majority of geese stopped feeding and flew back to the lake in in the evening at light levels lower than prevailed when they flew out in the morning (compare relation of flight to civil twilight, Figures 1 and 8). The earlier evening flights during cloudy weather and the often later flights when a moon was showing again demonstrated the rather critical responsiveness of geese to prevailing light (Fig. 8).

Since temperature always increased above 15° or 20° F in midday, even

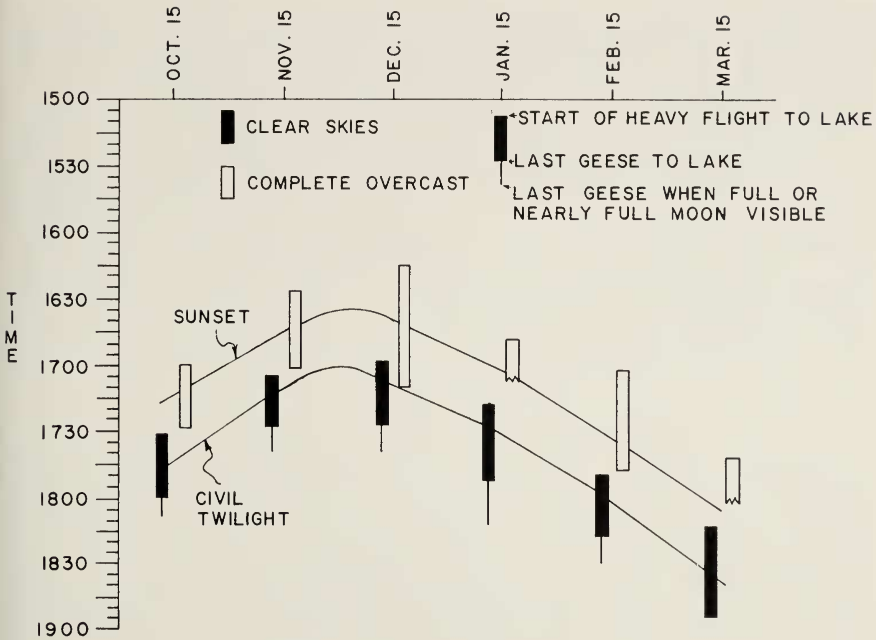

FIG. 8. Generalized average flight pattern of Canada Geese to roost lake under clear and complete overcast skies (sunset and civil twilight from U. S. Naval Observatory, 1961, 1962, 1963).

on the coldest days, temperature never caused a cessation of flight in the afternoon as occurred in the morning.

As in the morning, some records of afternoon flight times of radio-marked geese indicated short-term regularity of time of flight with respect to the initiation of the heavy flight during clear weather. Most records, however, revealed that the time of flight of an individual or family was not predictable within the 30 to 40 minute time span in which the majority of geese flew back to the lake.

NOCTURNAL ACTIVITY

Little time was spent by the investigators at Crab Orchard during the night. However, personnel residing at the refuge informed us when, on rare occasions, night flights and feeding activity occurred (excluding migration). When night activity occurred, effects were noticeable during the day because some geese stayed out far beyond their regular time of return to the lake in the evening or were encountered in fields prior to dawn civil twilight. Extensive activity at night was encountered only during one period in this study. This occurred when snow covered over 75 per cent of the ground and at the time of a full and nearly full moon from 13 to 19 February 1965. The reflection of moonlight off the snow caused brighter than usual conditions and the majority of geese remained out after 19:00 and continued feeding. The usual daily patterns of flight and activity were noticeably changed.

In contrast to the rarity of night activity at Crab Orchard, it was relatively common at Horseshoe Lake and Union County Refuges, also in southern Illinois (refuge personnel, pers. comm.). Such activity seemed to be related to heavy hunting pressure. Again, geese demonstrated their plasticity and ability to change normal regular patterns when extreme conditions prevailed. Markgren (1963:369) noted that Bean Geese (*Anser fabalis*) were normally diurnal but could change to almost complete night activity when affected by disturbance.

DISCUSSION

Initiation of Morning Flight.—Measurements of light levels were not performed in this study but can be estimated from other data. Canada Geese initiated morning flight in Saskatchewan when light intensity was 32 foot-candles as measured with a light meter pointing east (or 11 foot-candles with the meter pointing north) (A. Dzubin, Canadian Wildlife Service, in litt.). These geese began flight 15 minutes before sunrise under clear skies, as did the geese at Crab Orchard (Fig. 2).

Schreiber (1967) presented data on the rate of change of light intensity under clear and cloudy skies. From this it can be estimated that it takes 15 minutes longer to reach 25 foot-candles intensity (overhead reading) under cloudy skies than under clear skies. This delay in reaching the approximate threshold reacted to by the geese as recorded by Dzubin equals the delay of flight initiation observed under cloudy skies in this study. Beyond this low threshold value, the length of time required to reach higher light intensities shows wider differences between cloudy and clear sky conditions (Schreiber, 1967). Thus, the first geese to fly did so at approximately the same light intensity regardless if it was cloudy or clear, but the majority of geese flew under darker sky conditions on cloudy mornings than on clear mornings. Therefore, light acted as a trigger but not as a graded controlling factor.

Birds awaken in a rhythm even in constant light (Palmgren, 1949). Light is correlated with and probably influences the beginning, length of, and ending of many activities. Dawn and dusk represent the times at which external physical factors influencing synchronization of social flocks is probably easiest (Wynne-Edwards, 1962:326). Several studies have demonstrated the sensitivity of waterfowl to dawn or dusk light changes (Bossenmaier and Marshall, 1958; Winner, 1959; Martin and Haugen, 1960; Hein and Haugen, 1966).

No generalizations can be made as to the tendency of a particular single or family to be constant in initiation of morning flight as they tended only to be predictable within the 30 to 40 minute time span in which the majority of the flock flew. Many factors can influence the time at which geese fly; nearness to other birds taking off, presence or absence of disturbing factors (e.g., predators), synchronization of a pair or members of a family (Raveling, 1969*c*), and many unknowns (e.g., hunger, sleep, time since awakening, etc.). Apparently, all these factors contribute to variability in flight initiation of individuals and families.

Temperature.—Birkebak et al. (1966*a*) calculated the magnitude of heat loss for varying temperatures for *maxima* and *parvipes* utilizing a methodology verified by Birkebak et al. (1966*b*). LeFebvre and Raveling (1967) related these heat loss calculations to winter distribution of each race. The data in Table 2 demonstrate that Canada Geese become inactive at temperatures almost identical to those predicted to be the minimum at which they could survive for extended periods (i.e., up to 15–20 days) while utilizing almost all their energy metabolism for maintenance at a moderate work level of metabolism (see LeFebvre and Raveling, 1967). These relations suggest that inactivity is the most adaptive response to severe cold and functions to conserve energy and is an important factor determining northern limits of distribution in winter. Markgren (1963:325) noted comparable inactivity of Bean Geese during the coldest days of winter.

Feeding Periods and Midday Activity.—Cold per se seemed to have little or no influence on the length of the feeding period but instead caused a cessation of activity. Canada Geese at Crab Orchard were in good physical condition as judged by body weights during the winter of 1964–65 (Raveling, 1968). If the geese were requiring more food during mid-winter, it appears that ample time was afforded by the normal 2 to 2½ hour morning feeding period and the one hour evening feeding period to obtain that extra food. Geese did not spend a majority of their feeding period actually feeding; much time was also spent in alertness, loafing, and sometimes in aggression. Increased cloudy weather in mid-winter rather than cold temperatures led to geese remaining away from the lake for longer periods of time and provided further opportunity for spending more time feeding.

Geese that returned to the roost lake on cloudy days often flew out again within 1 or 2 hours. Geese apparently avoided the large lake during completely cloudy weather and sought water during bright clear periods. When a strong wind created noticeable waves or small "whitecaps," geese moved into nearby sheltered bays or flew from the lake in large numbers, even during clear weather. Cloudy weather was often associated with stormy conditions, rain, and wind. It appears that selection or conditioning or both have produced a state of fear in geese associated with such weather.

When the main roost lake(s) is small and ponds or other small water areas are available in feeding areas, then large numbers of geese regularly day-roost in the fields on or near these small water areas. This situation prevailed at Union County and Horseshoe Lake Refuges. Markgren (1963:372) observed a comparable pattern in Bean Geese.

We suggest that fear of predators by geese is an important factor influencing habitual utilization of water areas during non-feeding periods in calm, clear weather. When on water, geese are almost completely safe from mammalian predators. Geese spent the night on the water, but very often loafed on the bank during the day. Even on land, Canada Geese did not readily flee from mammalian predators, but rather they "mobbed" them by walking parallel to the predator while honking continuously. The near presence of a Golden Eagle (*Aquila chrysaetos*) or a Bald Eagle (*Haliaeetus leucocephalus*), however, occasioned rapid and somewhat disorganized flight back to the roost lake or nearest water if the geese were in fields. If an eagle approached them on water, however, the geese resorted to diving and rapid movements on the surface of the water, but they usually did not fly back over land. We suggest that this resort to water and diving in the presence of an eagle is adaptive and prevents successful attack by an eagle. Thus, fear of predators influences the geese to be on or near water during non-feeding periods of the day, whereas fear of rough water and stormy conditions influences the geese to remain on land.

Another important factor influencing length of time spent in fields during cloudy weather is that the goose's "sense of time" seems to be impaired. This was most noticeable and revealing on days when the sun finally appeared through the cloud cover at a time after which the geese would normally have gone back to the lake if the sun had been visible all morning. Within 5 to 15 minutes after such a "sunflash," thousands of geese that had still been feeding or were loafing began a mass flight back to the lake. Their cessation of feeding and other activities was almost immediate and they began the alertness and characteristic Head-tossing (Raveling, 1969*c*) that precedes flight. It seems that the azimuth position of the sun as well as increasing and decreasing light intensity at dawn and dusk, is an important factor regulating the onset, duration, and cessation of daily activities of Canada geese.

Several species of birds have been demonstrated to possess a sun orientation mechanism of time sense (see reviews by Kramer, 1961; Schmidt-Koenig, 1965).

Management Implications.—Knowledge of the usual rhythm of daily activities of geese under a variety of conditions has been and will be useful in manipulating shooting hours during the hunting season. For example, in the area containing the refuges in southern Illinois, goose hunting is not legal after 15:00. Thus, during clear weather, the heavy flight of geese in the afternoon is allowed to leave the refuge and be relatively unharrassed during their feeding period. Although many goose hunters in southern Illinois believe that the geese "learn that it is safe" to come out at 1500 hours, comparison of the length of the evening feeding period (Table 4) to the time at which geese return in the evening (Fig. 6) shows that this is the usual pattern of a relatively undisturbed flock. There were relatively light effects of hunting pressure at Crab Orchard as compared to other refuges because of the size of the refuge and its relation to numbers of geese. However, where hunting pressure is extreme, geese may become conditioned to time periods when they are not pursued.

Various other manipulations of shooting hours have been tried at other locations, e.g., no shooting before 09:00 or after 14:00 (cf. Hunt, et al. 1962). Such manipulations can achieve many effects, e.g., increased or decreased kill and wider dispersion of the harvest. Each situation should be studied as an individual case.

SUMMARY

Based on daily observation of the activities of a large wintering flock of Canada Geese and specific records of radio-marked families and individuals, the times and nature of flight patterns of these geese are described along with the environmental variables associated with these patterns. Characteristics of flight patterns were: regularity of onset of morning and evening flights in relation to light intensity under similar weather conditions; regularity of onset of the heavy flight with respect to the first geese which flew and the prevailing light levels, usually at or just after sunrise in the mornings and between sunset and civil twilight in the evenings; variability of individuals and families within the regularity exhibited by the flock as a whole; delay of flight under completely cloudy conditions; longer periods of time spent in feeding areas when cloudy, but not when cold provided it was not too cold to prevent flight; considerable delay in flight time or usually cessation of flight when below 15° F. The motivation and probable adaptive nature of goose responses to roosting on or near water during clear weather or in fields during stormy weather and their cessation of activity in cold periods are discussed.

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THE NEOTROPICAL NEST REGISTRY

A Nest Registry system has been formed to record in a systematic fashion information on the breeding biology and nesting of neotropical birds. A detailed discussion of the rationale for and the difficulties associated with such a registry appears in *American Birds* for February, 1972 (vol 26, pp. 18–20). Contributions from Mexico, Central and South America, and the West Indies, are needed, and nest reports for primarily neotropic species elsewhere would also be valuable. Contributions need not be in the form of a standard nest record card, although entries typed on 4 × 6 index cards, one card per species, would be desirable. Information to be published by the contributor will, of course, be respected. In lieu of submitting detailed nest records, a statement of for what species and in what countries, nest information exists, would help keep the Registry file complete. Part of the Registry file will consist of a library of reprints containing papers on life history studies or on specific aspects of reproductive biology of neotropical birds. Send requests for information, or contributions of nest data or reprints to Michael Gochfeld, Department of Ornithology, American Museum of Natural History, New York, New York 10024.